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## INTRODUCTION.

This REVIEW is based on reports for September, 1889, from 2,297 regular and voluntary observers in the United States and Canada. These reports are classified as follows: 178 reports from Signal Service stations; 120 monthly registers from United States Army post surgeons; 1,460 monthly registers from state weather service and voluntary observers; 24 reports from Canadian stations; 168 reports through the Central Pacific Railway Company; 347 marine reports through the co-operation of the Hydrographic Office, Navy Department; marine reports through the "New York Herald Weather Service;" monthly weather reports from the local weather services of Alabama, Arkansas, Colorado, Dakota, Illinois, Indiana, Iowa, the Iowa Weather Crop Bulletin Service, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, Meteorological Report of the Missouri State Board of Agriculture, Nebraska, Nevada, New England, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Texas, and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

## CHARACTERISTICS OF THE WEATHER FOR SEPTEMBER, 1889.

For a limited portion of the Atlantic coast the most prominent meteorological feature of the month was the storm which advanced from the Windward Islands, West Indies, to the middle Atlantic coast from the 3d to the 12th, inclusive. The course of this storm, together with the high tides attending it, caused a considerable amount of damage along the New Jersey and the western part of the Long Island coasts. The proximity of this storm to the great commercial centres of the country, together with the prostration of telegraph lines and interruption of railway travel, gave rise to the belief and statement that this storm was one of the great hurricanes of the century. The collated observations, however, whether considered with reference to the low point reached by the barometer, to the steepness of the barometric gradient, to the violence of attending winds or their sudden and changing direction, or whether from the more important points of damage to maritime interests by delays of vessels or other losses, or finally with reference to the loss of human life, this storm presents in all these characteristics conditions less marked and fatal than have frequently occurred in connection with other West India storms. The data on this point will be found with the detailed description of the storm. The passage of this cyclone was forecast by this office in a manner so successful as to indicate not only the value of this service, but the degree of accuracy which can often be attained in the display of cautionary and storm signals. The storm failed at Wood's Holl, Massachusetts, to even reach a half gale, while at Cape Hatteras the wind velocity was barely half that which has been before reached and the gale was by no means severe. During this time the Signal Service warnings specifically indicated dangerous winds between Nantucket and Cape Hatteras, and ship owners were informed that vessels could sail to the northward from Nantucket, but not to the southward, and on the North Carolina coast could sail to the southward, but not to the northward.

Acknowledgments of the material value from warnings of this office appear in the description of the storm. This storm was not particularly destructive over the West Indies, and the track of the centre of this disturbance can only be approximately located from the 4th to the 8th, owing to the absence of reports over an area ranging from four to six hundred miles in diameter covering the region of lowest pressure. After passing to the north of the thirtieth parallel it doubtless increased in energy, and was apparently forced to the westward by an area of high pressure to the northward, and this abnormal movement of the storm-centre was attended by gales of hurricane force, which caused considerable loss to shipping, and unusually high and destructive tides from New England to the Carolinas. Severe storms also prevailed over mid-ocean during the presence of this storm off the American coast. An important West Indian hurricane moved westward over the Caribbean Sea from the 13th to 17th, inclusive, and thence apparently passed over Yucatan and recurved to the north-central coast of the Gulf of Mexico by the 22d. Attending the passage of this hurricane, a storm, commencing during the afternoon of the 18th, devastated the coast of Campeche. On the morning of the 19th a storm which had suddenly developed great energy was central off the coast of Maine, whence it moved northward with a rapid decrease in energy. Severe local storms were most frequently reported in Texas and Indian Territory, where they were noted for five dates. The Arctic ice reported near Newfoundland corresponded in distribution with, but in quantity was somewhat in excess of, the average for the month.

The month was generally cooler than the average September, except in the Saint Lawrence Valley, the Canadian Maritime Provinces, northeastern New York, the north-central and northeastern parts of the upper lake region, at Jacksonville, Fla., over the southern plateau region, and on the Pacific coast south of the Columbia River. The greatest departures below the average temperature occurred in north-central Texas and Indian Territory, where they were more than five degrees. The departures above the average temperature were less than four degrees. The highest mean temperature reported for the month was 91°.3, at Cactus, Cal., and the lowest was 31°.7, at Pike's Peak, Colo. At New Ulm, Tex., seventeen years record, the mean temperature, 74.6, was one degree below the lowest September mean previously reported, noted in 1876. The highest absolute temperature reported was 116°, at Mojave, Cal., and the lowest minimum temperature, exclusive of Pike's Peak, Colo., where 2° was registered, was

5°, at Dolly Varden Mines, Colo., and 8° at Alma and Breckenridge, Colo. At one or more stations in Minnesota, Colorado, Arizona, Washington Territory, Louisiana, and Maine, respectively, the maximum temperature was as high or higher than previously noted for September, while at one or more stations in Florida, Texas, Illinois, Iowa, Kansas, Montana, Indian Territory, Arizona, Utah, Idaho, Oregon, and Washington Territory, respectively, the minimum temperature fell as low or lower than reported for September of preceding years. Damaging frost was reported in Nebraska on the 2d; in Minnesota on the 6th, in Wisconsin on the 16th, in Iowa on the 17th, in Iowa, Michigan, and Wisconsin on the 18th; in Iowa and Wisconsin on the 19th, in Michigan and Ohio on the 22d, in New York on the 23d, in Kansas on the 24th, in Michigan, Nebraska, and Iowa on the 27th; and light frost was reported as far south as the Carolinas, northern Georgia, northern Alabama, central Texas, southern New Mexico, east-central Arizona, central Nevada, and northern California. Killing frost was seasonable in the districts where it occurred.

The heaviest rainfall reported for September, 1889, was 16.71 inches, at Lehigh, Ind. Ter., and the rainfall exceeded ten inches in southern Florida, north-central and eastern Texas, southeastern Kansas, central Kentucky, central New Jersey, southeastern Pennsylvania, and central Virginia. In western Arizona, a greater part of California, in west-central Kansas, east-central Minnesota, western Nebraska, western Nevada, south-central Oregon, and northwestern Utah, no rain fell. The rainfall was generally below the average for the month in the Rocky Mountain and plateau regions, and on the Pacific coast, while to the eastward of the Rocky Mountains the rainfall was very unevenly distributed, large excesses and marked deficiencies occurring in adjoining states and districts. The greatest deficiencies occurred on the south Atlantic coast, in west-central Mississippi and thence southwest to the Gulf coast, where they were more than three inches. In the middle Saint Lawrence valley the rainfall exceeded the average by more than five inches, while in extreme southeastern New York, southeastern Tennessee, and in the upper valley of the Red River of the North the excess was more than four inches. In the south Atlantic states, the Lake regions, the upper Mississippi valley, the northeastern slope of the Rocky Mountains, and in the plateau regions there was a deficiency of rainfall for the current and the preceding month. Snow fell in September, 1889, as far south as extreme northern Texas, where three inches were reported at Folsom on the 23d.

Navigation on the Mississippi River above Dubuque, Iowa, was reported practically closed during the latter part of the month on account of low water. Noteworthy auroral displays were noted at Mount Washington, N. H., 8th; Saint Vincent, Minn., 18–19th, and Eastport, Me., 22d. Damaging drought was reported in parts of eastern Maine, Alabama, Ohio, Michigan, Dakota, and Nevada. Extensive forest fires occurred in Dakota, Michigan, Maine, Colorado, Montana, Oregon, and northern California, and large prairie fires in Minnesota and Dakota. Brilliant meteoric displays were observed at Greensborough, Ala., and Lexington, Ky., on the 24th, at Chattanooga, Tenn., on the 25th, and at Las Vegas, N. Mex., on the 29th.

## ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for September, 1889, as determined from observations taken daily at 8 a. m. and 8. p m. (75th meridian time), is shown on chart ii by isobars. The difference between the mean pressure for September, obtained from observations taken twice daily at the hours named, and that determined from hourly observations varied at the stations named below as follows: At Washington, D. C., New York, N. Y., Boston, Mass., and Chicago, Ill., the mean of the 8 a. m. and 8. p. m. observations was higher by .007, .005, .007, .004, respectively, than the true mean pressure, while at Saint Louis, Mo., the mean of the observations taken at these hours was the same as that determined from hourly observations.

The mean pressure for September, 1889, was highest from Missouri and Arkansas eastward to the Atlantic coast, at stations on the New England and Nova Scotia coasts, and from the north Pacific coast east and southeast over the valleys of the Columbia and Snake rivers, where it rose above 30.05. From the Saint Lawrence Valley, the lower lakes, and the southern portion of the upper lakes southward to the Gulf of Mexico, over a greater part of the middle and northern plateau regions and the middle eastern slope of the Rocky Mountains, and on the Pacific coast north of the fortieth parallel the mean values were above 30.00. The mean pressure was lowest in the lower Colorado valley where it fell to 29.82 at Yuma, Ariz., and in the British Possessions north of Dakota and Montana, where a reading of 29.85 was reported at Qu'Appelle, N. W. T. The mean pressure fell below 29.90 along the northern boundary of the United States between the eighty-fifth and one hundred and tenth meridians, and from the lower Colorado valley northwestward over California to the lower Sacramento valley.

Compared with the pressure chart for August, 1889, a decrease in pressure is shown east of the one-hundredth meridian, save on the Atlantic coast from Massachusetts northward, while over the Rocky Mountain and plateau regions there was an increase in mean pressure. The greatest decrease in pressure occurred over the eastern part of Lake Superior, where it amounted to .10, and the greatest increase over the middle and northern plateau regions, where the mean values were .15 to .19 higher than for the preceding month. In August the mean pressure was highest from the Ohio Valley eastward and southeastward to the Atlantic coast, where it rose above 30.10, while for the current month the highest values were noted in the east-central and extreme northwestern parts of the country, where they were above 30.05. The area of low pressure central in August over the Colorado valley contracted in area, and an increase in mean pressure of about .05 occurred in that region. There was also a slight increase in mean pressure in the British Possessions north of Montana and Dakota.

Compared with the normal pressure for September the mean pressure was generally below the normal east of the plateau regions, except in areas in New England, the Canadian Maritime Provinces, Florida, Missouri, and Arkansas, where the readings corresponded with or slightly exceeded the normal values. Over the plateau regions and along the Pacific coast the mean pressure was above the normal. The greatest departures below the normal pressure occurred at stations along the Atlantic coast between the thirty-sixth and fortieth parallels, and from northern Dakota eastward over Lake Superior, where they exceeded .05, and the most marked departures above the normal were reported in the middle and northern plateau regions, and on the Pacific coast north of the Columbia River, where they were more than .05.

### BAROMETRIC RANGES.

The monthly barometric ranges at the several Signal Service stations are shown in the table of miscellaneous meteorological data. The general rule, to which the monthly barometric ranges over the United States are found to conform, is that they increase with the latitude and decrease slightly, though somewhat irregularly, with increasing longitude. In September, 1889, the monthly ranges were greatest in northern New England, where they exceeded 1.00, whence they decreased southwestward to less than .40 over southern Florida and to less than .50 on the west Gulf coast, and decreased westward to the Pacific coast where they varied from less than .40 on the